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Description

Insulating material piece for an electrical high-voltage device and method for production thereof

The invention relates to an insulating material piece for an electrical high-voltage device, in particular for a high-voltage power breaker, the insulating material piece having at least one subvolume which is treated so as to change its conductivity, and to a method for producing such an insulating material piece.

An insulating material piece is known, for example, from the patent specification DE 198 26 202 C2. In order to reduce the electrical resistance in surface areas which are subjected to increased dielectric load, these areas of the manufactured insulating material piece are irradiated with beta or gamma radiation. Treatment with high-energy radiation influences the particle bonds of the insulating material. In particular in the case of plastics, which have long-chain compounds, breakage of the particle bonds brings about embrittlement of the material. As a result, the mechanical strength is reduced. In order to achieve the robustness required for the technical application, the insulating material pieces which are treated in this manner are given correspondingly large dimensions.

The invention is based on the object of configuring an insulating material piece having at least one treated subvolume such that the insulating material piece has improved mechanical strength.

The object is achieved according to the invention in the case of an insulating material piece of the type mentioned initially by the insulating material piece at least partially comprising a mixture of treated subvolumes and untreated subvolumes.

A mixture of treated and untreated subvolumes makes it possible, depending on the mixing ratio of the volumes with respect to one another, to achieve increased robustness with an electrical conductivity which is different to that for the untreated material. It is thus possible, for example, to provide the untreated subvolumes in order to ensure the mechanical strength and to use the treated subvolumes for the purpose of influencing the electrical properties of the insulating material piece. Treatment can be carried out in accordance with various methods. It is thus possible to treat subvolumes mechanically, chemically or, for example, using high-energy radiation such as alpha, beta or gamma radiation.

A further advantageous refinement may provide for the mixture to lie at least partially on the surface of the insulating material piece.

Mixture is understood here to mean the random distribution of various subvolumes within a total volume. The properties of the subvolumes which are combining with one another are not changed by this combination.

An arrangement of the mixture along the surface of the insulating material piece makes it possible to influence the electrical properties of the insulating material piece in a particularly simple and direct manner. It may also be provided for the entire insulating material piece to be formed from a homogeneous

mixture of treated and untreated subvolumes. An arrangement of the mixture merely in specific surface areas of the insulating material piece allows for targeted control of the electrical behavior. It is thus possible for specific leakage current paths to be constructed in a targeted manner on the insulating material piece for the purpose of dissipating surface charges. The leakage current paths may also pass through the interior of the insulating material piece and lead up to electrodes, for example.

Provision is advantageously also made for the treated subvolumes to be embedded in the untreated subvolumes.

Embedding of the treated subvolumes in the untreated subvolumes makes it possible for insulating material pieces to be produced which, whilst having high mechanical strength, have favorable properties as regards a changed electrical resistance, in particular on the surfaces of the insulating material piece. The untreated subvolumes are in this case provided for the purpose of ensuring sufficient dielectric strength and mechanical strength of the insulating material piece. The treated subvolumes influence these properties only at certain points and do not lead to substantial weakening of the insulating material piece as regards mechanical and dielectric properties. By selecting the mixing ratio of untreated and treated subvolumes, the degree of embedding can easily be influenced. A proportion of treated subvolumes which is less than that for untreated subvolumes provides for sufficient embedding when the components are mixed. In the case of a large proportion of treated subvolumes, they should be mixed in well, for example, in order to ensure sufficient embedding. The proportion of treated subvolumes in the total volume of the

mixture may be, for example, 10, 20, 30, 40 or 50%.

Provision may be made for the subvolumes to be made of PTFE.

Polytetrafluoroethylene (PTFE) has a very high insulating capacity. One disadvantage of the very high insulating capacity is the fact that electrical charges collect on the surface of a PTFE insulating material piece but cannot flow away to a sufficient degree owing to the insulating capacity. Jeopardized areas are thus produced which have an increased electrical field strength which can cause the occurrence of electrical flashovers or partial discharges. A configuration according to the invention of insulating material pieces, which are formed from PTFE and which comprise treated and untreated subvolumes, reduces the risk of the occurrence of jeopardized areas.

A further object of the invention is to specify a simple and cost-effective method for producing an abovementioned insulating material piece for an electrical high-voltage device.

The object is achieved according to the invention by treated subvolumes being mixed with untreated subvolumes, and the mixture being shaped so as to produce an insulating material piece.

Mixing treated and untreated subvolumes makes it possible to produce the mixing ratio with different compositions depending on the desired properties for the insulating material piece. In the process, it is possible

to use various methods for treating the subvolumes.

Provision may furthermore be made for the mixture to be sintered.

The subvolumes are frequently present in the form of granules. The large number of individual subvolumes or granule particles can be combined in a suitable manner using the sintering method.

The invention will be illustrated schematically in a drawing with reference to an exemplary embodiment below and will be described in more detail in the text which follows.

In the drawing:

figure 1 shows a section through an insulating material nozzle, and

figure 2 shows a block diagram of a method for producing an insulating material nozzle.

An insulating material nozzle 1 illustrated in figure 1 is used in high-voltage power breakers in order to influence the burning and quenching of a switching arc and to direct the flow away of switching gases. The insulating material nozzle 1 has a base body which has a through-channel 2. The base body is formed from an insulating material, for example polytetrafluoroethylene (PTFE). The channel 2 is essentially in the form of a cylinder at one of its ends. At the other end, the channel 2 expands in the form of a funnel. At that end of the channel 2 which is in the form of a funnel, the surface of the insulating material nozzle 1

is partially formed from a mixture of a first subvolume 3 (⊗) and a second subvolume 4 (O). The first subvolume 3 is formed from a large number of subvolumes (granules) which was subjected to high-energy radiation, for example alpha, beta or gamma radiation. The second subvolume 4 is untreated and is likewise formed from a large number of subvolumes. The treated subvolumes of the first subvolume 3 are embedded in the subvolumes of the second subvolume 4. That is to say, the subvolumes of the second subvolume 4 are present in greater quantities than the subvolumes of the first subvolume 3. In addition to the various configurations shown in figure 1, other surface areas of the insulating material nozzle 1 can also be formed using a mixture comprising treated subvolumes and untreated subvolumes. The further surface areas can be arranged on the insulating material nozzle, for example at the end or on the casing side. In addition, provision may furthermore be made for the entire insulating material nozzle 1 to be produced from a mixture of treated and untreated subvolumes.

A method for producing an insulating material nozzle which overall comprises a mixture of treated and untreated subvolumes is illustrated schematically in figure 2. The first subvolume 3, coming from a first collecting container 5a, is guided past a beam gun 6 and irradiated with gamma radiation. By varying the period of time for or intensity of the radiation, the electrical properties can be influenced to a varying degree. The second subvolume 4, coming from a second collecting container 5b, is fed to a mixing apparatus 7 as is the treated first subvolume 3. The required quantities of treated and untreated subvolumes are mixed with one another

in the mixing apparatus 7. The mixture formed in this way is combined in a mold 8, for example by means of a compacting method, to form a molding. Then, the molding can be sintered to form a solid molding. At the end of the process, an insulating material nozzle is produced which is formed from a first subvolume 3 and a second subvolume 4. The insulating material nozzle can now be used or be subjected to further processing steps.

In accordance with this method, it is also possible to produce insulating material bodies which only partially have a mixture of treated and untreated subvolumes.